the microscope is adjusted so that the diameter of the field is eight small squares. One hundred fields are then counted, disregarding the ruling of the counting chamber. The resulting number multiplied by .7957728 will give the number of pus cells in 1 c.mm.

The factor .7957728 is found by the following means:

The field is eight squares in diameter. The radius expressed in mm. is .2 mm. The area of one field is Pi r^2 or 3.1416 x .04 equals .125664. The depth of the chamber is .1 mm.; therefore, the volume of one field counted is .125664 x .1 equals .0125664. If .0125664 equals the volume of 1 field, 100 fields equal 100 x .0125664 or 1.25664. 1.25664 is greater than 1 c.mm., 1 c.mm. divided by 1.25664 equals .7957728 or the factor with which to multiply to obtain the number of cells in 1 c.mm.

The following figures have been chosen, arbitrarily, to designate the degree of pyuria:

0	per c.mm.	No pus cells.....0	Per field 0.
0-100	" "	Very few.....1 plus	" 1.
100-300	" "	Few 2	" 2 to 3.
300-500	" "	Moderate amount..3	" 4 to 6.
500-700	" "	Many 4	" 6 to 8.
700 plus	"	Loaded 5	" 9 or more.

The variation of specific gravity has no great influence upon computations, but we have adopted 1000 as a standard and the formula expressed as follows:

The known specific gravity is to 1000 as the number of pus cells in 1 c.mm. is to x.

e. g., 1020 : 1000 :: 102 : x.

As a control in the count following prostatic massage the bladder is thoroughly irrigated and finally filled with 100 cc. of mild antiseptic solution. This is voided after massage and the count made using this 100 cc. as a standard quantity. The estimate here, as elsewhere, is relative.

It is desired to convey the suggestion that in making plural counts the physical character and quantity of the urines should be closely similar.

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TREATMENT OF GOITRE

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When we review the history of goitre, we find that for many years it was regarded as a disease to be treated by medicine alone. It was largely the work of Kocher that made the surgical treatment so successful. Year by year, with increasing experience, and technical skill, surgeons have lowered the mortality rate and have taught the profession, as well as the laity, the need for early operation if irreparable damage is to be avoided. The development of X-ray and Radium therapy has opened up new fields in the treatment of many diseases, and it is not surprising that the goitre problem has received its share of attention. The pendulum has swung from medicine to surgery and now seems to be swinging towards radio-therapy. Much of the treatment is done, unfortunately, in a perfunctory manner, without sufficient thought and care, without proper choice of cases, and without a knowledge of those general principles which are so essential to the intelligent choice of therapeutic methods.

It would seem that a word of warning is particularly needed at this time when this form of treatment is so often carried on by physicians, or even technicians, who have had little or no experience in the treatment of goitre, or even with general radiotherapy.

Our whole system of modern medicine is based upon correct diagnosis. When a diagnosis of thyroid disease has been made only the first step has been taken towards establishing a rational basis for treatment. It is just as necessary to recognize clearly the various forms of thyroid enlargement as it is to distinguish one type of intestinal parasite from another, or to differentiate empyema from pneumonia.

The clinician and the pathologist do not entirely agree upon the classification of goitre, as the pathological picture is not always in accord with the clinical findings. However for practical purposes the following classification meets all requirements.

GOITRE

Atoxic	(1)	Simple hypertrophy, adolescent goitre
	(2)	Colloid, calcified or cystic
	(3)	Simple adenoma
Toxic	(1)	Toxic adenoma
	(2)	Hyperplastic (exophthalmic)
Malignant	(1)	Carcinoma.
	(2)	Sarcoma, etc.

In well developed cases it is usually easy to classify goitre into these groups, but there are many border-line cases giving rise to mild signs and symptoms in which an accurate estimate of the glandular function is essential. It is not only necessary to know that an increased or decreased function exists but also the degree of that changed function. This is often impossible clinically, for a large goitre may actually be deficient in thyroid secretion, while a barely noticeable gland will produce an extreme degree of hyperthyroidism. The thyroid secretion now appears to be the principal regulator governing metabolic processes in the body. By determining

the basal metabolism in goitre patients, an accurate estimate of thyroid activity is secured.

As far back as 1883, Lavoisier made studies in basal metabolism. Many other investigators have contributed to this subject since his time. Briefly, the output of CO_2 bears a direct ratio to the rate of tissue destruction. By measuring the O intake, or the CO_2 output from the lungs over a given time, the rate of tissue destruction is determined. This rate is a constant in all healthy individuals, when taken under standard conditions of food and rest, and corrected for the body weight. It is, therefore, the normal or basal metabolic rate of chemical change within the body cells. While this rate varies very little in health it may be either increased or decreased by disease. With the simplified apparatus now obtainable for this estimation, it is rapidly becoming a valuable adjunct to diagnosis.

A number of diseases influence the metabolic rate, but the changes found in goitre are the most striking of any. In exophthalmic goitre, the rate may actually be doubled—cases of +115 per cent increase having been reported—while in myxedema it may fall to 25-40 per cent below normal. Even allowing for a certain error in the determination, it is more accurate than any clinical estimate and gives a measure of the degree of changed function. It should be used to corroborate clinical findings, not only in toxic conditions but also in large non-toxic goitres where hypothyroidism may be an unlooked for and unrecognized condition. It is invaluable in determining the dose of thyroid extract or thyroxin to be given in myxedema, also in checking up toxic goitres relapsing after operation.

Again, it is valuable in determining the opportune time for operation, or that stage in which the experienced clinician has what Plummer calls a "hunch," that operation will be well borne. At the Crile and Mayo Clinics radical operation is not done in those toxic cases showing a basal metabolism over +50 per cent. Medical treatment, ligation of the superior thyroid arteries and X-ray are used until this point is reached, before removal of the gland is done. However, the time for operation must not be selected upon the basal metabolism alone, as the phase of the disease, from a clinical standpoint, is even more important. All toxic-goitre patients have alternating periods of exacerbation and recession. They do not stand operation well during those periods when the disease is on the increase, even though the metabolic rate is well below +50 per cent.

Simple and adolescent goitre: This form usually comes on in early life, during the period of adolescence. The thyroid is uniformly and moderately enlarged and there is a corresponding increase in all its histological parts. As a rule, it presents few or no symptoms and the metabolic rate is not increased. It is believed by Marine to be an expression of an effort on the part of the thyroid to compensate for a deficient iodin supply in food and water. This form of goitre usually responds to medical treatment with small doses of iodin. Various forms of iodin may be used. One of the simplest and most pleasant is the Syrup of the Iodid of Iron in twenty-minim doses daily, every alternate month. If medical treatment is not successful, X-ray therapy may be tried in addition to the use of iodin, the lack of which is believed to be the cause of the hypertrophy.

Colloid, calcified and cystic goitre: This type of non-toxic goitre may appear at any age. It comes usually late in life, it grows slowly and is often confined to one lobe. When both lobes are involved they are usually unequal in size. Symptoms are from pressure only. The metabolic rate is usually not affected but may be below normal if the normal thyroid tissue is sufficiently destroyed or compressed. The treatment is purely surgical and is called for to relieve pressure and to improve the appearance of the patient. I can not too strongly emphasize that in these cases the X-ray is definitely contra-indicated and if used may destroy the remaining thyroid tissue and bring on hypothyroidism.

Simple and fetal adenomata: These forms are believed to arise from embroyonic cell rests. They are usually bilateral, discrete, freely movable masses, multiple in number, varying from the size of a shot to that of a baby's head. They appear at any time in life and grow slowly. Many, later, show toxic signs, others either calcify or degenerate, and become cystic. All tend to compress and replace normal thyroid tissue. Many grow to such size that they produce pressure symptoms upon nerve trunks, the trachea or the oesophagus. The basal metabolism is not changed. The principles of treatment are the same as those for colloid goitre and X-ray is again strongly contra-indicated.

Toxic adenoma: A certain percentage of the simple adenomata become active and produce all the toxic signs and symptoms found in exophthalmic goitre *except the exophthalmos.* These adenomatous masses are usually multiple, circumscribed, vary in size and may affect both lobes. While heart changes, rapid pulse, loss of weight, weakness, diarrhoea and an increased basal metabolism are present, these signs are usually less marked than in hyperplastic goitre. The patient generally states that she has had a goitre for many years, but it occasioned her little trouble until she was about 35. *In contra-distinction to this type, a true hyperplastic goitre, as a rule, gives marked symptoms within one or two years after its appearance.* Any toxic adenoma with a basal metabolism above +10 per cent is producing heart changes and should be treated. Some exhibiting mild toxic symptoms may show an increased basal metabolism only during periods of exacerbation.

X-ray does not affect this type of goitre and is definitely contra-indicated as in simple adenomas. It not only does not alter the adenomas but it damages the remaining norml thyroid tissue which may be barely sufficient in amount to maintain health. It is this change in normal thyroid tissue which is responsible for the apparent though temporary benefit frequently seen after radiation. These masses should be removed surgically, while

taking great care to preserve the normal thyroid tissue surrounding them.

Hyperplastic or exophthalmic goitre: This is the type with which we are all reasonably familiar and more seriously concerned. Exophthalmos, either unilateral or bilateral, with positive von Graefe and Stellwag sign; pulsating goitre mass, either large or small; rapid, irregular heart, often showing signs of hypertrophy and myocarditis; tremor of the hands and tongue; diarrhoea; rapid loss of weight; marked nervousness and change in disposition and a greatly increased basal metabolism are all signs which make diagnosis easy. *In contra-indication to the toxic adenoma these goitres develop within one to two years and the signs and symptoms are often recognized before the thyroid enlargement is noticeable.*

Even when these classical signs are not sufficiently well developed to warrant a diagnosis of hyperthyroidism, the basal metabolism is already well above normal and furnishes the first reliable proof that the disease is present.

The pathological picture shows the acini, normally tubules, lined with a single layer of cells, now packed with newly formed epithelial elements, all active in secretion.

Fortunately, it is upon this type of growth that X-ray and Radium has its most effective action. As in Cancer, these newly formed cells, resembling the embryonic types, are most affected by radiation. Here, Roentgenotherapy may be of the greatest value, and if not curative, very helpful in decreasing the amount of thyroid secretions and the signs and symptoms of toxicity. In some cases, radiation is apparently curative, in others the effect is temporary and this treatment must be followed by a bilateral resection of the gland, with or without previous ligation of the superior thyroid arteries.

The milder forms of treatment are especially useful in preparing the patient for operation when the metabolic rate is above +50 per cent.

Hyperthyroidism is a rapidly progressive disease. Permanent heart damage keeps pace with its advance. While conservative treatment should be given a fair trial, the tendency to procrastinate and dilly-dally along with these toxic goitres can not be condemned too strongly. Treatment must not only be beneficial but positively curative, reducing and keeping the metabolic rate well below +20 per cent. Above this point, heart damage is still going on, even though the patient is much improved.

The use of Roentgenotherapy should be controlled by frequent determinations of the metabolic rate and quickly followed by resection if continued and rapid improvement does not occur.

Malignant growth—Carcinoma, sarcoma, etc.: These conditions are relatively rare but are not infrequently seen. The diagnosis is based upon the same principles here as it is elsewhere in the body, namely, steady growth with fixation to the surrounding tissues. Naturally these tumors must be removed carefully and after that the area should be well treated with X-ray or radium.

SUMMARY

(1) It is necessary to determine accurately the type of goitre before rational treatment can be given. The basal metabolic rate is an important aid in corroborating the clinical findings.

(2) X-ray or Radium therapy is indicated in simple hyperplasia and hyperplastic goitres only. It is contra-indicated in colloid, cystic, nodular and adenomatous types.

(3) While the treatment of goitre is essentially surgical, medical treatment, Roentgenotherapy and radiotherapy are sometimes curative and are often helpful in decreasing thyroid activity and in preparing the patient for operation.

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A LABORATORY AND CLINICAL STUDY OF THE BACTERICIDAL ACTION OF SOLUTIONS OF RADIUM EMANATION

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Recent observations upon the use of radium emanation indicate that there is a possibility of employing this substance in the treatment of chronic dental abscesses. Until further laboratory data can be obtained, it appears advisable to mention briefly the results thus far recorded, with the hope that other workers in this field may be sufficiently interested to verify some of the conclusions.

The bactericidal action of radium has been studied particularly by Lequeux and Chrome,[1] and Iridell and Minett.[2] In their experiments they exposed different organisms to radium emanation for varying periods of time with a noticeable inhibitory effect upon the growth of cultures of streptococcus. Although the author has not repeated the experiments referred to above, his clinical findings are in apparent accord with the deductions offered. Bacteriological examinations of the treated canals indicated sterility in 85 per cent of the cases. In fact, the summary presented points to the possibility of a new application of radium in the treatment of certain diseased conditions.

The apparent success which has attended the radium therapy of skin lesions suggested the advisability of developing a modification of the present method of application which would make possible the study of the effects produced by this agent on chronic dental apical abscesses. A summary of nearly a year's observation of clinical cases shows that lesions of this type yield readily to the new therapy, and that up to the present time no untoward effects of the radium treatment have been observed.

Through the courtesy of Dr. Howard Morrow, Dr. Laurence Taussig, and Mr. L. B. Clark, it has been possible for the author to secure capillary tubes containing radium emanation. These tubes had been used in the skin clinic and eye clinic for various purposes until the "de-emanation" had